Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal Form

Section 1. General administrative information

Technical Support For PATH - James J. Anderson

Bonneville project number, if an ongoing project 9098

Business name of agency, institution or organization requesting funding
James J. Anderson Consulting

Business acronym (if appropriate)

Proposal contact person or principal investigator:

Name	James J. Anderson
Mailing Address	3700 E. Union St.
City, ST Zip	Seattle, WA 98122
Phone	206-543-4772
Fax	206-616-7452
Email address	jim@fish.washington.edu

Subcontractors.

Organization	Mailing Address	City, ST Zip	Contact Name

NPPC Program Measure Number(s) which this project addresses.

NMFS Biological Opinion Number(s) which this project addresses.

Other planning document references.

Subbasin.

Short description.
Critique of mathemathical aspects of PATH hypotheses.

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
X	Anadromous fish		Construction		Watershed
	Resident fish		O & M		Biodiversity/genetics
	Wildlife		Production		Population dynamics
	Oceans/estuaries	X	Research	X	Ecosystems
	Climate		Monitoring/eval.		Flow/survival
	Other		Resource mgmt		Fish disease
			Planning/admin.		Supplementation
			Enforcement		Wildlife habitat en-
			Acquisitions		hancement/restoration

Other keywords.

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
9600600	PATH-Facilitation	Will provide critique of PATH documents.

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Critique mathematical basis of passage and delayed mortality		
2	Critique mathematical basis of life cycle and ocean/climate hypotheses		
3	Experimental management design		

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	10/1998	10/2003	40.00%
2	10/1998	10/2003	40.00%
3	10/1998	10/2003	20.00%
			TOTAL 100.00%

Schedule constraints.

Completion date.
2003

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel	Salary, Fringe benefits and overhead	$46,800
Fringe benefits		
Supplies, materials, non-expendable property		
Operations & maintenance		
Capital acquisitions or improvements (e.g. land, buildings, major equip.)		
PIT tags	# of tags:	
Travel		$2,200
Indirect costs		
Subcontracts		
Other		1000
TOTAL		$50,000

Outyear costs

Outyear costs	FY2000	FY01	FY02	FY03
Total budget	$50,000	$50,000	$50,000	$50,000
O&M as % of total	25.00%	25.00%	25.00%	25.00%

Section 6. Abstract

The overall goal is to assist the region in developing the ability to identify and assess alternative hypotheses relating to salmon stock recovery and rebuilding in the Columbia River ecosystem. This project will provide critiques on the PATH hypotheses. The specific objective of this project is to critique and evaluate suitability of the mathematical frameworks on which the biological and ecological mechanisms of PATH hypotheses are formulated.

Section 7. Project description

a. Technical and/or scientific background.

Realizing the region benefits significantly from a coordinated and consistent approach to technical analyses supporting salmon rebuilding and recovery efforts, the NWPPC (Ibid., Sec. 7.3) called for "....a process to provide for continuing review, coordination and development of analytical tools to assist decision making, facilitate program evaluation and identify critical uncertainties._ PATH evolved to provide the region the best available scientific methods and information in the analyses supporting recovery/rebuilding efforts.

Dr. James Anderson expertise is in mechanistically based mathematical models of ecological systems. He will provide this expertise to the PATH through this technical support. In particular, the efforts will focus on issues involving fish passage and life-cycle hypotheses. Dr. Anderson will also contribute to planning of adaptive management experiments.

Previous contributions to PATH studies include:

-critique to smolt passage hypotheses

-critique of effects of descaling on smolts

-critique of the effects of flow on smolt survival

-critique of the impacts of estuary timing on smolt survival

-critique of the delayed mortality hypotheses

b. Proposal objectives.

Objective 1. Critique mathematical basis of passage and delayed mortality .

Issues of passage and the connection to delayed mortality will be critiqued for scientific and mathematical rigor. In particular, effort will be devoted to resolving differences in the alternative passage models through analysis of their mathematical formulations and the biological basis of the formulations.

Products: PATH reports.

Objective 2. Critique mathematical basis of life-cycle and ocean/climate cycle hypotheses.

The mathematical basis of life-cycle models and in particular the mathematical formulations of the ecological mechanisms of ocean and climate factors will be considered and reviewed.

Products: PATH report.

Objective 3. Experimental management

Participation in the development of experimental management approaches to test hypotheses on the impacts of hydrosystem, harvest and habitat on stock recovery.
Products: PATH report.

c. Rationale and significance to Regional Programs.

The region is using PATH to ensure that salmon recovery efforts are guided by scientific information, which is stated goal of the Fish Wildlife Program (FWP). Rationales for the Project Objectives in light of the purpose of the PATH process are below. All objectives are developed in cooperation with other participants of PATH from the state, tribal and federal agencies.

Objectives 1 relates to the FWP goal to optimize hydrosystem operations for fish passage. The work will contribute to developing the mathematical foundation of the programs.

Objective 2 relates to the U.S Congressional directive to consider the impacts of ocean conditions on stocks. The work will contribute to establishing the mathematical foundation for hypotheses on the impacts of the ocean and climate on fisheries.
Objective 3 relates to the need for the FWP to use an experimental adaptive management framework. The work will contribute to establishing the mathematical foundation for experiments.

d. Project history

Dr. Anderson's technical support to PATH is an extension of his contributions to PATH through other projects in which models and hypotheses have been formulated. This project will expand his critique role. Previous critiques were developed under contract (9700200). Past Critiques have included:

- A comparison of spawner recruit models (Anderson, Paulsen and Hinrichsen 1997)

- Critique on the transport and extra mortality hypotheses of the alpha and delta models (Anderson 1998).

e. Methods.

Dr. Anderson's contributions to PATH will involve evaluation of the mathematical basis of hypotheses. Critiques will evaluate individual and system wide implications of the hypotheses. For each objective several tasks are involved.

Task 1. Mathematical basis of hypotheses will studied to determine if the equations are mathematically correct and expressed in their simplified forms.

Task 2. Biological basis will be evaluated. Some hypotheses may have a general aggregated biological basis, others may be specifically related to mechanisms. The degree of connectedness of alternative hypotheses to biological and ecological first principles will be determined and critiqued

Task 3. Characterizing hypotheses responses through analytical and graphical analysis. Through this task the quantitative characteristics of hypotheses will be explored and compared to knowledge on the qualitative response of the ecosystem.
Task 4. Sensitivity analysis will be conducted to identify which hypotheses elements most important in determining the response of the hypotheses. The results of the sensitivity analysis in light of ecological and biological processes will be discussed.

f. Facilities and equipment.

This project involves minimum computer facilities and no major cost are required.

g. References.

Anderson, Paulsen, and Hinrichsen. 1997. Comparison of MLE Spawner-Recruit Models.

Anderson. 1998 Critique of transport and Extra Mortality Hypotheses.

Section 8. Relationships to other projects

This project is an integral part of the PATH process. Part of the critique of alternative hypotheses will be developed through this project.

Section 9. Key personnel

The principal investigator for this project is Dr. James J. Anderson.

Curriculum Vitae: James J. Anderson

Associate Professor (WOT)
Fisheries Research Institute and Center for Quantitative Science in Forestry, Fisheries and Wildlife
College of Ocean and Fisheries Sciences

Office Address	University Address
Columbia Basin Research Puget Sound Plaza 1325 - 4th Ave., Suite 1820 Seattle, WA 98101-2509 Phone: 206-543-4772	Fisheries Research Institute Box 358218 Seattle, WA 98195 Phone: 206-616-9174

FAX: 206-616-7452
e-mail: jim@fish.washington.edu
http://www.cqs.washington.edu

Teaching Activities:

Graduate course in modeling organism dynamics (QSCI 551)
Graduate course in Ecosystem models (QSCI 550)

Students Receiving Degrees: Three in M.S. Fisheries, Two in M.S. Quantitative Ecology & Resource Management, and Two in Ph.D. Quantitative Ecology & Resource Management.

Current Research Projects:

Bonneville Power Administration (Funding level: $6 million): Developing computer models for management of Columbia River hydroelectric and fisheries agencies.

U.S. Army Corps of Engineers (Funding level: $600,000): Developing analysis and computer models for the impact of gas bubble disease on migrating salmon.

National Marine Fisheries Service (Funding level: $300,000):

1) Studying mortality processes of juvenile salmon in tributaries
2) Developing a multi-species multi-regional salmon harvest model

Honors and Awards:

1) Research Faculty Fellowship, College of Ocean and Fishery Sciences 1985, 1989.
2) Special Recognition for participation in the U. S. Fish and Wildlife Service Fish Passageways and Division Structures course in 1990.
3) Nomination for Computerworld Smithsonian Awards in programming for the CRiSP computer model College of Ocean and Fishery Sciences Distinguished Research Award, 1996.

Professional Activities: Consulting; Expert Testimony on Fish Migration and Dam Passage; Guest Speaker

There is a total of 47 Publications. The 1997 Publications include:

Anderson, J.J. (in press) Decadal Climate Cycles and Declining Columbia River Salmon. Proceedings of the sustainable Fisheries Conference, Victoria B.C., Canada, 1996. Eric Knudsen, Editor. Special publication of the American Fisheries Society.

Anderson, J.J. 1997. Decadal Scale Climate Pattern and Salmon Survival: Indicators, Interactions and Implications, Estuarine and Ocean Survival of Northwest Pacific Salmon Workshop NMFS 1997.

Beer, W.N. and J.J. Anderson. 1997. Modeling the Growth of Salmonid Embryos. Journal of Theoretical Biology. 189(3) 297-306.

Zabel, R.W. and J.J. Anderson. 1997. A Model of the Travel Time of Migrating Juvenile Salmon, with an Application to Snake River Spring Chinook. North American Journal of Fisheries Management. 17:93-100.

Section 10. Information/technology transfer

Models, documentation correspondence for this project are available on the World Wide Web at http://cqs.washington.edu. Selected works are published in the reviewed literature or as BPA reports.